and continued to rise slowly with wind steady from the northeast. The wind continued from that direction until 3:25 a. m. of the 7th, when it suddenly shifted to the southwest with increasing velocity and a sudden rise in temperature, as shown on the thermograph trace, fig. 3.

The important point to note in this connection is the fact that temperature rose 7° from 10 p. m. of the 6th to 3:25 a. m. of the 7th with a wind blowing toward mountain slopes to the westward of the station.

Southwesterly winds and high temperatures prevailed until about 12:30 p. m. of the same day (7th) when the wind shifted to a northerly quarter with a cold wave.

We may now consider that one of two things happened. First, a considerable body of warm dry air may have become detached from the parent low, which still lay to the westward of the Rocky Mountains, and moved eastward in the general circulation. In this event the irruption of cold air from the north was merely a return to the conditions which had prevailed for some days before the approach of the low. Second, we may consider that the cold air from the north was the predominating influence, and that what was observed at Havre and Williston was the southern extension of a high area moving southeasterly from the British possession.

I should have said before that the first fall in temperature, shown on the thermograph sheet, was not accompanied by strong winds. In fact there was very little wind during the twelve hours that elapsed between the advent of the first cold wave and the return of the warm wave on the morning of the 8th.

The rise in temperature, last mentioned, occurred in connection with the advance of the original low, which had meanwhile reached Havre the second time. It advanced thence eastward and was followed by a cold wave, as shown by the thermograph sheets. The whole process, both at Havre and Williston, is beautifully shown by the instrumental tracings in figs. 3 and 4.

The essential difference between the temperature curves at Havre and Williston is in their steepness or slope. The aid of dynamic heating has been invoked to account for the sharp incline of the Havre curve with rising temperature. I wish to point out that the falls of temperature at this station are about as sharp as the rises.

Is it not largely a topographic rather than a dynamic effect in both cases?

The particular qualities which differentiate temperature changes at Havre from those of other regions are the suddenness of the change and the amplitude of the oscillation. It would seem as if a wall of warm or cold air, as the case may be, is transported bodily past the station much as a norther advances over the plains of Oklahoma and Texas. While a part of the heat of the so-called foehn wind is doubtless due to compression, it would seem that by far the greater part is due to the original temperature of the air before crossing the main divide of the Rocky Mountains.

WEATHER FORECAST CARDS BY RURAL DELIVERY.

In the report of the Ohio section for March Mr. J. Warren Smith, Section Director, advocates the possibility of distributing daily weather forecast cards by the system of free delivery mail matter in rural communities. The extension of the free delivery system to rural communities was undertaken some years ago by the Postoffice Department and is now recognized as of great benefit from a social, educational, and industrial point of view. Mr. Smith proposes to supply those farmers who request the daily weather forecast with postal cards delivered by the mail carriers whenever the latter start on their routes at the proper time. He finds that of the 49 rural routes in Ohio, the average number of families served is 100. About four-fifths of the carriers leave the postoffice before 10 a. m. In some cases the routes are so long that the carriers must start by 7 a. m., and are all day on the road, but at the greater number of places the carriers leave about 9 a. m. In order to test the value of the plan of Mr. J. Warren Smith, the Chief of Bureau has authorized the forecasts to be telegraphed at Government expense to all the postoffices in Ohio where the rural carriers start later than 10 a. m. As to the districts where the carriers start too early for this service it is recommended that farmers' clubs and institutes take into consideration the possibility of making better postal arrangements in order to secure the advantages of this service.

ICE AND NAVIGATION AT ST. MICHAEL, ALASKA.

Bulletin No. 40, by Lieut. D. H. Jarvis of the United States Revenue Cutter Service, contains additional notes for the Alaska Coast Pilot by the United States Coast and Geodetic Survey. It gives a table deduced from the records of the Alaska Commercial Company, showing the date when the ice first moved out of St. Michael Bay; the first arrival from the Yukon River; the first arrival from the sea; the close of navigation, as determined by the first formation of ice in St. Michael Bay. The location of St. Michael is about latitude 63° 5′ north and longitude 162° west. It is on the southeast shore of Norton Sound, about 100 miles from the mouth of the Yukon and a little more from Cape Nome. The Coast Pilot says:

The harbor of St. Michael, Norton Sound, is open to navigation, on an average, by the middle of June, the time of breaking up of the ice varying from about the last week of May to the last week June. The season of navigation usually closes in the latter part of October.

The winds in summer are generally moderate; but during September and October gales are strong and frequent, northerly winds predominating. These strong winds are of special importance to mariners on account of their effect on the height of the water; northerly and easterly winds lower the water and southerly and westerly winds raise it. With northerly winds of long duration the amount of change may be as much as 5 feet below mean low water.

The table above referred to is as follows:

Ice conditions at St. Michael, Alaska.

Year.	Ice moving out of St. Michael Bay.	First arrival from Yukon River.	First arrival from sea.	Ice forming in St. Michael Bay.
1878	....	....	July 1	Oct. 18-22.
1879	....	....	June 22	Oct. 21-25.
1880	June 22	....	June 28	Oct. 20-27.
1881	June 10	....	June 19	Nov. 7.
1882	June 8	June 17	June 24	Oct. 23.
1883	June 1	June 10	June 22	Nov. 6.
1884	June 10	June 17	....	Oct. 6.
1885	....	....	June 24	
1886	June 11	....	June 20	Oct. 22.
1887	....	June 15	June 20	Oct. 29-Nov. 6.
1888	May 31	June 8	June 25	Oct. 22-31.
1889	June 9	June 13	July 4	Nov. 10-16.
1890	June 3	June 6	July 13	Oct. 25-Nov. 9.
1891	June 6	June 7	June 29	Nov. 6.
1892	June 11	June 7	June 18	Oct. 29.
1893	June 10	June 14	June 24	Nov. 7.
1894	June 15	June 18	June 25	Oct. 26.
1895	June 18	June 19	June 29	Oct. 24-Nov. 4.
1896	June 25	June 27	July 7	Nov. 2.
1897	June 14	June 22	June 26	Oct. 18-21.
1898	June 13	....	June 13	Oct. 20-31.
1899	June 10	June 16	June 17	

The above table of ice conditions presents us with one of those general climatological characteristics that should apparently give us a sort of summary of the climatic conditions of each season. It is said that the rains on the coasts of California and Oregon have some connection with atmospheric conditions over Alaska. The preceding table may, therefore, furnish a basis for studies in this direction.

The last few pages of this same Coast Survey bulletin are devoted to the Arctic Ocean north of Alaska. Our knowledge of the meteorology of this region is so slight that every scrap of information is of value. The perusal of these pages by Lieutenant Jarvis suggests that this region is not so liable to severe cyclonic storms as it is to severe winds of the straight line type. The immense field of pack ice, whose border is rarely more than 20 miles north of the coast, drifts to and fro, obedient to the general resultant of the winds that prevail over an indefinite region northward, eastward, and westward. This drift of the pack differs, however, from that which would occur if the ocean beneath it were of great depth; the shallow water is driven by it in confused currents hither and thither and acts like a buffer, retarding the ice, but is itself also forced outward in all directions. Therefore vessels drift to and fro with the greatest irregularity, while the foot of the pack merely moves north or south. In general the great ice floe that covers the Arctic Ocean from America to Siberia appears to circulate about the pole with the winds and currents, moving eastward and northward on the Siberian side but eastward and southward on the American side.

OREGON WEATHER AND BERING SEA ICE.

In the March report of the Oregon section Mr. E. A. Beals, Section Director, quotes from a recent pamphlet by Mr. James Page, meteorologist to the United States, Hydrographic Office, On Ice and Ice Movements in Bering Sea in the Spring Months, as follows:

The pack ice annually moves, roughly speaking, as far south as latitude 58° N. and retreats in the summer to about 71° N., and it is natural to suppose that the movements of this large body of ice would have some influence on the climate of Oregon and Washington. By taking the two early years of 1890 and 1897 it is found that the May temperatures in Portland averaged 4° daily above the normal in the one case, and 2° daily above the normal in the other, and in both the rainfall was decidedly deficient.

The May rainfall has been deficient in years when the ice retreated northward more slowly, but in none of the ten years' record under consideration did the temperature exceed the normal with a slow northward movement, except in 1891, and then the excess was less than half a degree for each day.

The steamer *City of Seattle*, which arrived from Alaska March 31, brings the news that the ice in the Upper Yukon shows signs of breaking up, and that possibly the river will be navigable this spring six weeks earlier than usual.

It may be that the signs of an early spring on the Yukon also imply an early retreat of the pack ice in Bering Sea, and it will be interesting to note how (if this should be the case) the May temperatures in Oregon and Washington will respond for the third time to such conditions.

Vessel and year.	Entered into ice.	Emerged from ice.	Interval in ice.	Average date.	Portland, Oreg., for May. Rain.	Temperature.
	Day.	Day.	Days.	Day.	Inches.	°
1890.						
Steamship Orca	100	137	37	118.5		
Steamship Balaena	106	134	28	125.0		
Steamship Narwhal	111	122	11	116.5		
Steamship Grampus	123	135	12	129.0		
1891.				122.2	1.08	60.6
Steamship Balaena	103	155	52	129.0		
Steamship Orca	104	150	46	127.0		
Steamship Narwhal	112	155	43	138.5		
1892.				131.5	1.83	59.9
Steamship Orca	107	157	50	132.0		
Steamship Narwhal	108	140	32	124.0		
Steamship Beluga	109	143	34	126.0		
Steamship Grampus	123	141	18	132.0		
1893.				131.0	0.80	59.0
Steamship Orca	106	149	43	127.5		
Steamship Beluga	110	154	44	132.0		
Steamship Thrasher	118	154	36	136.0		
Bark John Winthrop	124	163	39	143.5		
1894.				134.8	2.30	54.4
Steamship Orca	103	144	41	123.5		
Steamship Thrasher	103	134	31	118.5		
Bark Wanderer	105	162	57	133.5		
Bark John Winthrop	110	147	37	128.5		
Steamship Beluga	112	149	37	130.5		
1895.				126.9	1.09	55.5
Steamship Orca	112	153	41	132.0		
Steamship Balaena	121	148	27	134.0		
Steamship Narwhal	122	146	23	134.0		
Steamship Grampus	129	152	23	140.0		
1896.				135.0	3.42	55.9
Steamship Narwhal	93	140	47	116.0		
Steamship Orca	105	146	41	125.0		
1897.				120.5	3.55	52.2
Steamship Thrasher	96	128	32	112.0		
Steamship Jeannette	101	133	32	117.0		
Steamship Narwhal	108	139	31	124.0		
Steamship Balaena	113	140	27	126.0		
1898.				119.8	0.90	61.4
Steamship Jeannette	110	136	26	123.0		
1899.				123.0	1.78	56.6
Steamship Bowhead	109	140	31	124.0		
Steamship Wm. Bayless	100	135	35	118.0		
				121.0	3.16	51.1

On referring to Mr. Page's pamphlet the reader will find a chart of Bering Sea, showing the southern limits of the ice field, on the average of ten years' of experience and observation, between April 15 and May 15. It appears that the southern edge of the ice will in normal seasons connect the Asiatic Continent at latitude 61°, and the American Continent at latitude 59° along an irregular line whose southern limit is, however, not an altogether safe index to the general character of the preceding winter. The early entrance of a vessel into this ice field by no means assures its early emergence from it. On the route northward the length of time spent in the ice pack and the average date between the entrance and emergence off Indian Point may give us a crude idea as tothe importance of the ice and its meteorological significance. The dates are expressed in days, counting from January 1.

If we compare the above figures showing the dates at which it was possible to navigate through the ice, we see a steady retardation of dates from 1890 to 1895, and increase of interval. If we accept these figures as in any way indicating the general character of the ice covering Behring Sea we may make this data the basis for comparing the temperatures at Portland, Oreg., with the condition of the ice. We have, therefore, in the above table added the temperatures and rainfall for May at Portland, thereby reproducing the data that Mr. Beals probably had at hand in writing his paragraph as quoted above. An early passage through the ice implies a rapid movement of the ice northward; therefore early dates in our fifth column should correspond with warm weather, and warm water and southerly winds in Bering Sea south of the ice pack. But the above table does not clearly show that early dates also correspond with warm weather or deficient rainfall in the subsequent month of May at Portland, except for the two years 1890 and 1897.

The whole series may be arranged in order of dates as follows:

Year.	Average date.	Temperature.	Rain.	Year.	Average date.	Temperature.	Rain.
1897	119.8	61.4	0.90	1894	126.9	55.5	1.09
1896	120.5	52.2	3.55	1892	131.0	59.0	0.80
1899	121.0	51.1	3.16	1891	131.5	59.9	1.83
1890	122.2	60.6	1.08	1893	134.8	54.4	2.30
1898	123.0	56.6	1.78	1895	135.0	55.5	3.42
Average	121.8	56.4	2.09	Average	131.5	57.1	1.89

THE BROOKLYN MUSEUM OF METEOROLOGY.

The Brooklyn Institute of Arts and Sciences has taken a leading position in the art of public instruction. There are in that city 200,000 children of whom about 90,000 do not go to school, and yet all are provided for in some way or other by the museums and lectures of the Institute at No. 185 Brooklyn avenue.

It is the purpose of the childrens' museum to build up gradually for the children and young people of Brooklyn and Queens County, a museum that will delight and instruct the children who visit it; to bring together collections in every branch of local natural history that is calculated to interest children and to stimulate their powers of observation and reflection; to illustrate by collections of pictures, cartoons, charts, models, maps, and so on, each of the important branches of knowledge which is taught in the elementary schools.

At the present time the collections exhibited in the museum illustrate many branches of industry, such as the iron production and manufacture, and many branches of science such as botany, zoology, geology, physiology and many other branches of knowledge, such as human anatomy, geography,